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#23 Declaration
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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF: :

Daniel CELERIER, et al. : GROUP ART UNIT: 3726

SERIAL NO.: 09/402,472 :

CPA FILED: June 15, 2001 : EXAMINER: JIMENEZ, M.

FOR: INTERNAL COMBUSTION ENGINE EXHAUST DEVICE AND METHOD FOR MAKING SAME

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TECHNOLOGY CENTER R3700

DECLARATION UNDER 37 C.F.R. §1.132

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

inventor

The undersigned, Alain PIERDET, herein declares:

1. That the undersigned is Engineer R & D, working in the Chassis Systems and Equipment Department of Renault. I am a specialist in sheet metal and in body shop mounting process at Renault. Therefore, I have launched a study concerning the fixation of lambda sensors on exhaust pipes using the technologies of flow-drilling and screw cutting by deformation. The aim of this study was to replace the method used until now by Renault involving a built up ring fixed by welding on the exhaust pipe, with a new method providing the same functions at lower cost. As part of this program, I have worked for a year with a specialist of flow drilling in order to establish a development plan for that matter.

2. That it is known to mount a sensor in an exhaust pipe of an engine.

3. That I have studied U.S. Patent Nos. 4,437,971 and 5,571,397. In my opinion,

U.S. Patent Nos. 4,437,971 and 5,571,397 represent conventional structures for exhaust sensor mounting structures and methods known to those skilled in the art at the time of the invention. Thus, these two patents don't tackle the matters of flow-drilling or boring. It is my opinion that the structures and methods described in U.S. Patent Nos. 4,437,971 and 5,571,397 present numerous cost and manufacturing disadvantages such as successive use of two different technologies and two different operations, namely boring and welding. These disadvantages were solved by the present invention recited in the pending claims because it allows to obtain the same functions as with the known methods but at a lower cost for the following reasons. Only one device is used, for two operations, namely flow-drilling and flow-boring. The material of the exhaust pipe flows in order to form a flange which acts to stop the leaks towards the outside of exhaust pipe, and to form a sleeve screwed towards the inside. During the study, the flow-drilling device has been adjusted to obtain the tightness of the sealing plan. The bore is now thoroughly circular, and it doesn't need to be repaired by the operators. There is no more welding operation, and therefore no more projection on the sealing plan, which is then thoroughly tight. The invention allows also to simplify the organization of the working stations, as well as the equipment. The bonding between the sensor and the exhaust pipe is perfect with regards to the screwing and to the final tightness.

4. That it is known to drill a hole using a flow-drilling operation.

5. That it has not been known to use a flow-drilling operation to mount a sensor in an exhaust pipe of an engine. The flow-drilling operation was used for drilling holes in the automobile industry generally, as evidenced by an article entitled "RVI Annonay: le fluoperçage fait gagner du temps" (a copy of this article, as well as an English translation, is attached hereto) that describes the use of flow-drilling in the construction of bus bodies, chassis, and seats. However, the formation of a flow-drilled hole and mounting of a sensor

therein in an exhaust device for an internal combustion engine is conspicuously missing from this article.

6. That it is my opinion that the formation of a flow-drilled hole and the mounting of a sensor therein in an exhaust device for an internal combustion engine satisfied a long-felt and unsatisfied need in the engine exhaust system art. The long-felt need is evidenced by the generalization of this new method on the whole range of Renault engines. In fact, the proposed solution, which deployment has begun since 1998, has been rapidly accepted because it is easy to implement, it is reliable and it allows to save one Euro on each hole. For these reasons, the invention replaces today on all the engines, the previous method of inserting and welding a screwed sleeve on the exhaust pipe.

7. The undersigned declarant further states that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Typed Name: Alain PIERDET

Signature:

Date: 29/11/2002

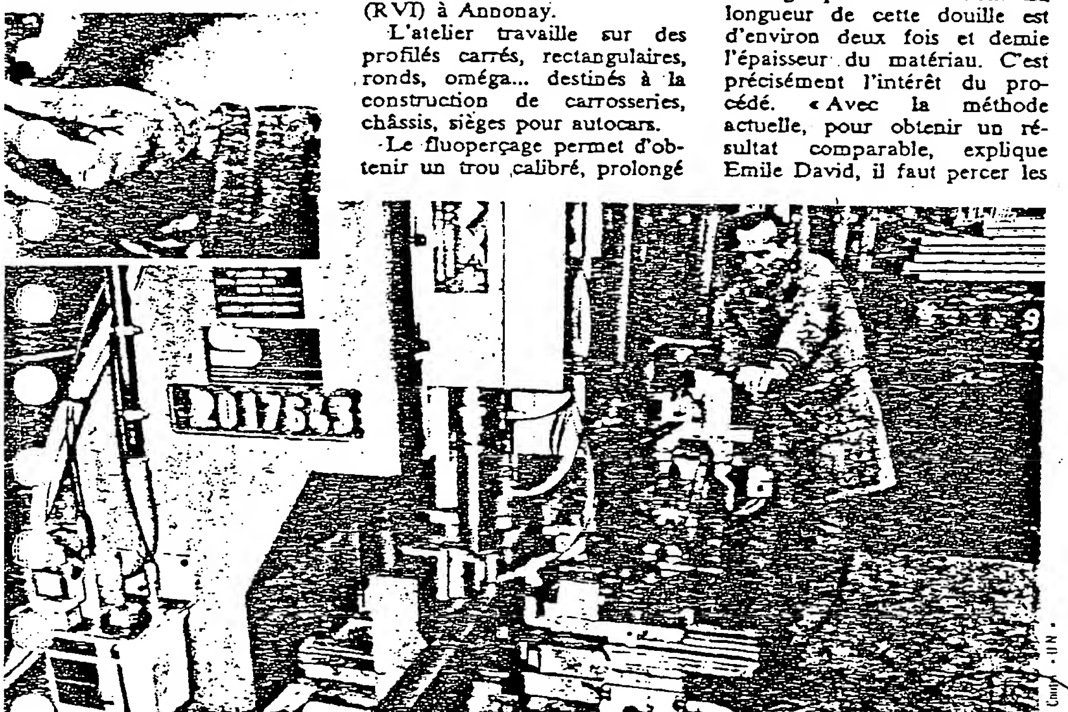
RVI Annonay : le fluoperçage fait gagner du temps

Gain de temps, simplification des nomenclatures, suppression des inserts soudés : tels sont les avantages constatés par RVI après neuf mois d'utilisation du fluoperçage pour la fabrication d'éléments de cars et d'autobus.

« C'EST pour supprimer les inserts soudés que nous avons décidé d'appliquer le fluoperçage », déclare Emile David, responsable des méthodes à l'atelier de débit-tronçonnage de Renault Véhicules industriels (RVI) à Annonay.

L'atelier travaille sur des profilés carrés, rectangulaires, ronds, oméga... destinés à la construction de carrosseries, châssis, sièges pour autocars.

Le fluoperçage permet d'obtenir un trou calibré, prolongé par une douille qui peut être utilisée comme raccord, comme palier, ou recevoir un taraudage par déformation. La longueur de cette douille est d'environ deux fois et demie l'épaisseur du matériau. C'est précisément l'intérêt du procédé. « Avec la méthode actuelle, pour obtenir un résultat comparable, explique Emile David, il faut percer les trous au gabarit, souder sur table les inserts, meuler les soudures, redresser les pièces et tarauder. » La simplification des méthodes s'accompagne donc d'un gain de temps et d'une simplification de la nomenclature, avec la suppression d'un composant. La chaleur dégagée par l'opération est localisée et ne provoque pas de déformation de la pièce.



Fluoperçage d'un carré de 40 mm × 2 mm d'épaisseur pour longerons d'autobus. En cartouche : poinçon de 6 mm en carbure pouvant effectuer 40 trous/heure.

G Cuny – UN

L'équipement, livré par Somex, est essentiellement constitué d'un bâti standard avec table et de deux unités d'usinage, l'une pour le fluoperçage, l'autre pour le taraudage (par refoulement), pour un coût d'investissement total de 25 000 francs. La puissance de ces unités est de l'ordre du kilowatt. Le même constructeur fournit également les poinçons en carbure, qui, pour l'instant, sont prévus pour des diamètres de 6 et 8 mm.

Actuellement, le procédé est encore en phase d'expérimentation et de démarrage à RVI-Annonay, et la plupart des pièces existantes sont toujours traitées par la méthode conventionnelle. Car la mise en œuvre du fluoperçage nécessite des modifications importantes, non seulement au niveau des méthodes, mais aussi lors de la conception des produits.

Il en résulte que la machine actuelle est encore loin d'être exploitée à fond. « Elle sera chargée progressivement au fur et à mesure de l'arrivée en fabrication des nouveaux produits, prévoit Emile David : pour l'instant, une vingtaine de pièces différentes sont à l'étude pour la construction de cars et d'autobus. » Chaque nouvelle pièce nécessite la confection d'un gabarit réalisé par la section outillage de l'entreprise

Une durée de vie de 20 000 opérations

Néanmoins, l'équipement, installé en septembre 1981, est déjà couramment utilisé pour percer et tarauder des trous de 6 mm de diamètre dans des longerons en tube carré de 40 mm de côté, 2 mm d'épaisseur et de 1.5 à 4,3 m de longueur. Cadence : 35 pièces/heure. Les seuls réglages à effectuer sont ceux des profondeurs de perçage et de taraudage, qui ne nécessitent aucun démontage des unités d'usinage. Le passage d'une pièce à l'autre ne demande pas plus de vingt minutes. La durée de vie du poinçon, qui tourne à 3 500 tr/mn, est estimée à 20 000 opérations, et le coût unitaire des poinçons en carbure est de 850 francs. Des outils qui, selon les utilisateurs, sont fragiles et supportent mal les chocs mécaniques ou thermiques.

EDMOND DEGRANGE

Le fluoperçage : un perçage sans copeaux

Le procédé de fluoperçage permet de réaliser des trous (jusqu'à 30 mm) dans des tôles métalliques, des tubes, des profilés de faible épaisseur (de 1,5 à 8 mm) en aciers courants (jusqu'à 120 kg/mm²), en alliages légers et en cupro-alliages. Il n'y a pas de copeaux. Le perçage résulte de la perforation de la paroi par un poinçon en carbure de tungstène tournant à grande vitesse (500 à 5 000 tr/mn) et appliqué contre la surface au moyen d'une broche comparable à une unité de perçage. Le poinçon comporte une pointe conique suivie d'un corps apparamment cylindrique, mais dont la section est, en fait, un polygone à angles largement arrondis. Le contact de la pointe en rotation rapide provoque une élévation locale de température qui amène le métal à l'état plastique. La poussée exercée sur le poinçon par le système d'avance continue le fait pénétrer dans le trou ainsi ébauché en refoulant le métal autour de lui. Le métal flue dans le sens de l'avance en formant une collerette et en sens inverse en formant un bourrelet. En quelques secondes, on obtient ainsi un trou calibré prolongé par une douille qui supprime le recours aux inserts et aux écrous soudés.

ATTACHMENT (English Translation)

PRODUCTION

RVI ANNONAY:
flowdrilling saves time

Time savings, a simplification of parts lists, the elimination of welded inserts: these are the advantages noted by RVI after nine months of using flowdrilling to manufacture motor coach and bus parts.

"We decided to use flowdrilling to eliminate welded inserts," says Emile David, head of methods at the cutting output shop of Renault Véhicules Industriels (RVI) in Annonay.

The shop works on square, rectangular, round and hat shapes... intended for the construction of bus bodies, chassis and seats.

Flowdrilling makes it possible to obtain a calibrated hole extended by a bushing that can be used as a connector, as a bearing, or that can be threaded via deformation. The length of this bushing is around two and a half times the thickness of the material. This is precisely the interest of the process. "With the current method, to get a comparable result," explains Emile David, "you have to drill the holes in the template, weld the inserts on a table, grind the weld seams, straighten the parts and tap." The streamlining of the methods means a time savings and a simplification of the parts list, with the elimination of a component. The heat released by the operation is localized and does not cause any distortion of the part.

The equipment, delivered by Somex, essentially consists of a standard frame with a table and two machining units, one for flowdrilling, and the other for tapping (via upsetting) for a total investment cost of 25,000 francs. The wattage of these units is around one kilowatt. The same manufacturer also supplies the carbide punches, which, for the time being, come in diameters of 6 and 8 mm.

At present, the process is still in its experimental and startup phase at RVI-Annonay, and most of the existing parts are still produced using the conventional method. For using flowdrilling requires significant modifications not only in methods but also during product design.

The result is that the current machine is still far from being used to its full extent. "It will progressively be responsible for the arrival of new products in manufacturing," predicts Emile David: "for the moment, some twenty different parts are being designed to construct motor coaches and buses." Each new part requires the company's tooling department to produce a template.

A use life of 20,000 operations.

Nevertheless, the equipment installed in September 1981 is already commonly used to drill and tap holes 6mm in diameter in square-tube side members with 40-mm sides, 2mm thick and 1.5 to 4.3 m long. Speed: 35 parts/hour. The only settings that need to be adjusted are the drilling depth and tapping depth, which do not require any dismantling of the machining units. The shift from one part to the next does not require more than twenty minutes. The use life of the punch, which rotates at 3,500 rpm is estimated at 20,000 operations, and the unit cost of the carbide punches is 850 francs. Tools that, according to users, are fragile and do not tolerate mechanical or thermal impacts well.

Edmond Degrange

Flow drilling:
drilling without shavings

The flowdrilling process makes it possible to make holes (up to 30 mm) in metallic sheets, tubes and thin profiles (from 1.5 to 8 mm) of [Illegible] steel (up to 120 kg/sq. mm) of light alloys and master alloys. There are no shavings. The drilling results from the perforation of the wall by a punch made of tungsten carbide that turns at high speed (500 to 5,000 rpm) applied to the surface by means of a drill pin comparable to a drill [Illegible]. The punch comprises a conical tip followed by an apparently cylindrical body, but whose section is in fact a polygon with largely rounded corners. The contact of the rapidly revolving tip causes a local rise in temperature that brings the metal to the plastic state. The thrust exerted on the punch by the continuous advance system causes it to penetrate into the hole thus started, pushing back the metal around it. The metal yields in the direction of advance, forming a collar and, in the opposite

direction, forming a rim. In a matter of seconds, you thus obtain a calibrated hole extended by a bushing that eliminates the need for inserts and [Illegible] nuts.

[Photo caption]

Flowdrilling of a square 40 mm x 2 mm thick for bus side-members.
Insct: a 6-mm carbide punch capable of producing 40 holes/hour.